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Impact of a quality improvement program on primary healthcare in Canada: A mixed-method evaluation

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ABSTRACT

Purpose: Rigorous comprehensive evaluations of primary healthcare (PHC) quality improvement (QI) initiatives are lacking. This article describes the evaluation of the Quality Improvement and Innovation Partnership Learning Collaborative (QIIP-LC), an Ontario-wide PHC QI program targeting type 2 diabetes management, colorectal cancer (CRC) screening, access to care, and team functioning.

Methods: This article highlights the primary outcome results of an external retrospective, multi-measure, mixed-method evaluation of the QIIP-LC, including: (1) matched-control pre-post chart audit of diabetes management (A1c/foot exams) and rate of CRC screening; (2) post-only advanced access survey (third-next available appointment); and (3) post-only semi-structured interviews (team functioning).

Results: Chart audit data was collected from 34 consenting physicians per group (of which 88% provided access data). Between-group differences were not statistically significant (A1c [$p = 0.10$]; foot exams [$p = 0.45$]; CRC screening [$p = 0.77$]; advanced access [$p = 0.22$]).

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Qualitative interview ($n = 42$) themes highlighted the success of the program in helping build interdisciplinary team functioning and capacity.
Conclusion: The rigorous design and methodology of the QIIP-LC evaluation utilizing a control group is one of the most significant efforts thus far to demonstrate the impact of a QI program in PHC, with improvements over time in *both* QIIP and control groups offering a likely explanation for the lack of statistically significant primary outcomes. Team functioning was a key success, with team-based chronic care highlighted as pivotal for improved health outcomes. Policy makers should strive to endorse QI programs with proven success through rigorous evaluation to ensure evidence-based healthcare policy and funding.

1. Introduction

Primary healthcare is the foundation of any high-performing healthcare delivery system [1,2]. When organized and utilized to be effective and efficient, better healthcare can be achieved at lower costs, with successful early detection of disease, secondary prevention of illness, and improved health and well-being of individuals with chronic disease [2]. This can all be done within an environment that is familiar, comfortable, and accessible for patients [2]. Large-scale reforms targeting the Ontario primary healthcare system have been implemented over the past decade striving for this ideal, with a transition from a reactive model of acute, episodic care, to a proactive patient-centred system focused on health promotion, disease prevention, and chronic disease management [1,3–5]. One such reform introduced Family Health Teams (FHTs) in 2005 in Ontario, Canada, primary health care organizations characterized by: (1) group practice and practice networks; (2) patient enrolment and rostering; (3) changes to PHC governance and accountability; (4) funding and compensation; (5) creation of multidisciplinary care teams including family physicians, nurse practitioners/registered nurses, and other health care professionals (for example, social workers and dieticians); (6) internet technology infrastructure; and (7) education/training with a focus on quality improvement [3,6–8]. Similar to the team-based organization of Community Health Centres (CHCs), these transformations presented significant challenges to those delivering care, including the need to develop new care processes, make meaningful use of new technology, and adapt team-based approaches for chronic disease prevention and management [9–12]. To support primary healthcare organizations in Ontario with these challenges, the Quality Improvement and Innovation Partnership (QIIP), now amalgamated with Health Quality Ontario (HQO), was established as a provincial organization by the Ministry of Health and Long-Term Care (MOHLTC) in 2008.

1.1. Quality Improvement and Innovation Partnership

Between 2008 and 2010, the QIIP launched three waves of a quality improvement (QI) learning collaborative (LC) program based on the Institute for Healthcare Improvement Breakthrough Series (IHI-BTS) adult-learning model [13] and the Model for Improvement strategy of using small tests of change to determine impact prior to larger scale implementation [14]. Incorporating the concepts of the Chronic Disease Prevention and Management Framework [15], the purpose of this program was to educate, train, and enable primary healthcare teams to improve chronic disease management and outcomes of the population they serve by providing effective, efficient, accessible, comprehensive, and patient-centred, team-based healthcare. The LCs were designed to target the challenges of developing and adopting a chronic disease management approach by providing participants opportunities to learn to work together as a PHC team, and better utilize allied healthcare provider skills to improve care and adherence to clinical practice guidelines. Program activities focused on assisting interdisciplinary teams within FHTs and CHCs to: (1) improve type 2 diabetes (T2DM) management; (2) increase colorectal cancer (CRC) screening; (3) optimize patient access to primary healthcare ("advanced access"); and (4) improve team functioning. These four topic areas served as proxies for the ability of FHTs and CHCs to improve care in three domains: (1) chronic disease management; (2) disease prevention; and (3) office access and efficiency. Each wave of the QIIP-LC program consisted of three learning sessions, two action periods between the learning sessions, and one summative congress at the end. The learning sessions introduced Plan-Do-Study-Act (PDSA) methodology [16] and Ontario's CDPM framework [15]. A description of the program is provided in Table 1, with a detailed program logic model pending publication. Participation in the QIIP-LC program was voluntary and open to primary healthcare organizations across Ontario.

1.2. Evaluation of quality improvement initiatives

QI initiatives have the potential to improve chronic disease management, health promotion and disease prevention; however there have been few evaluations to support their significant financial and programmatic investment. More rigorous and comprehensive evaluations are needed to examine the effects of these programs on health outcomes and sustainability [17–23]. Thus, a rigorous and comprehensive external evaluation was designed to examine the impact of the QIIP-LC program on T2DM management, CRC screening, advanced access, and team functioning. Building from lessons learned from the recent evaluation of the Partnerships for Health program (PFH), a similar QI initiative in primary healthcare in Ontario, Canada [24], this evaluation incorporated a control group

Table 1
QIIP learning collaborative program characteristics.

Length of the program	The program was delivered over three waves of learning col|laboratives from 2008 to 2010. The length of each wave of learning collaborative from pre-work to Congress ranged from 15.5 to 17 months
Pre-work	Teams were required to (a) form a working group within their organizations who would participate in program activities that was representative of all key clinical (family physicians, allied healthcare professionals) and administrative roles, (b) define the patient population, (c) familiarizing themselves with the Collaborative Charter, measurements, and monthly reporting scheme, (d) develop a team statement and a story board, and (e) participate in two conference calls to learn about methodology
Learning sessions/Congress	**Learning Session 1 (two days)**: Education about Chronic Disease Prevention and Management (CDPM) Framework, Model for Improvement and PDSA cycles, access and office efficiency, delivery system design, patient education for self-management, measures for improvement, electronic medical record (EMR) information management, diabetes care and management, CRS, process mapping, community resources and partnership, decision support, and team leadership.**Learning Session 2 (two days):** Content related to office practice redesign, process mapping, use of EMR, care process design, specific office process changes to better manage diabetes and to improve colorectal cancer screening, work as an interdisciplinary team, and community partnership.**Learning Session 3 (two days):** Re-cap of material, education on spread of lessons learned and improvement to other colleagues, education on sustainability of QI, factors that impact QI, and creative thinking and innovation.**Congress (half day):** Showcased teams' achievements and lessons learned; attended by organization leaders (FHT, CHC, professional leaders, primary healthcare decision makers) as strategy to spread and sustain improvements; guest speakers and panel discussions.
Action periods (between learning sessions/congress)	Implement QI activities in the practice; identify areas for improvement; implement PDSA cycles; collect data from EMR; report on monthly measures
Practice coaches/facilitators	Monitored teams' performance and provide assistance to ensure the teams were able to adhere to the program activities; on-site visits; attended team meetings; review monthly report
Teleconferences	Teams provided and discussed information presented at learning sessions, lessons learned and experiences.
Web-based virtual office	Communication and discussion with project implementation team and other participating teams throughout the province; upload monthly reporting measures

design to strengthen the methodology described in detail below.

2. Methods

Investigators external to the program implementation team conducted a rigorous mixed-method, multi-measure evaluation of the QIIP-LC program on T2DM management, CRC screening, advanced access to care, and team functioning. The evaluation included: (1) development of a logic model and assessment oriented process evaluation of the program; (2) a cluster, matched-control, pre-post chart audit on the management of T2DM and rate of CRC screening; (3) a controlled post-only survey of practices participating in the chart audit on advanced access to healthcare; (4) semi-structured, post-only, in-depth telephone interviews; (5) post-only web-based participant survey; and (6) health administrative data analysis with the Institute for Clinical Evaluative Sciences (ICES).

This paper presents the results of the chart audit, advanced access survey, and interviews related to the impact of the QIIP-LC program on the primary outcomes: T2DM management (glycated haemoglobin [A1c] and foot exams), CRC screening, advanced access, and team functioning.

Evaluation of the QIIP-LC program was approved by the Research Ethics Board at The University of Western Ontario and Queens University. A waiver of patient consent for the chart audit was granted under the Ontario Personal Health Information Protection Act (PHIPA) from the Ethics Review Boards.

2.1. Participants

2.1.1. Quantitative – chart audit and advanced access survey

Primary healthcare (PHC) teams (family physicians, allied care providers, and administrative staff) from FHTs and CHCs across Ontario were randomly selected from a sampling framework based on the proportion of teams by: (1) model of care (FHT/academic FHT/CHC); (2) practice setting (rural/urban); (3) wave of LC; and (4) geographical region (Local Health Integration Networks were grouped into regions). Teams were considered eligible for the evaluation if they joined the QIIP-LC program and did not formally withdraw. One PHC QIIP-LC physician per team was randomly recruited for the chart audit and survey. Matched controls were non-participating physicians identified based on the sampling framework of their matched QIIP-LC physician. To maximize the effectiveness of the control group, and minimize the risk of contamination, potential control physicians were identified using a pragmatic priority approach. Control physicians practicing in FHTs were, ideally, recruited within the same FHT organization as QIIP-LC teams (but not located at the same practice site), and ranked according to distance from their matched QIIP physician. Control physicians practicing in CHCs were recruited from separate CHC organizations

Table 2
Quantitative primary outcome measures and patient chart eligibility criteria.

Program focus	Primary outcome measure(s)	Patient chart eligibility criteria	Timeline of data collection
Type 2 diabetes mellitus (T2DM) management	• The proportion of patients with an annual foot exam (process measure) • A1c value of patients above study target A1c (≥7.3%) at baseline (clinical outcome measure)	• Rostered to the physician at least one year prior to the program • Did not leave the practice or deceased • At least 18 years of age • Diagnosed with type 2 diabetes • Diagnosed at least one year prior to the program	• Retrospectively from 12 months prior to each physician's start date in the QIIP-LC program to 12 months following the end of the program
Colorectal cancer (CRC) screening	• Proportion of eligible patients screened for CRC (defined as referral/requisition of FOBT, sigmoidoscopy, or colonoscopy)	• Rostered to the physician at least one year prior to the program • Did not leave the practice or deceased • Between the age of 50 and 75 • No colonoscopy in the past five years • No prior history of colon cancer	• Retrospectively from 24 months prior to each physician's start date in the program to 24 months after their start date • Two independent samples of patients were randomly selected for each 24-month period
Advanced access	• The number of regular clinic days until the third-next available appointment.	• Not applicable	

(CHCs typically operate at one practice site). Physicians were eligible if they had been in practice at least one year prior to the commencement of the QIIP-LC with a minimum of 20 patients with T2DM in their practice.

2.1.2. Qualitative semi-structured interview

PHC team participants were selected using a two-step sampling process. First, 10 teams were purposefully selected from a sampling framework similar to the chart audit to ensure representation by model of care, practice setting and geographical region. Second, a purposeful and iterative sampling strategy was used to select participants reflecting maximum variation in clinical and administrative roles and to ensure that both the physician and executive leads from each of the teams were included. Four senior program administrators from the QIIP-LC implementation team and seven QI coaches were also selected as key informants.

2.2. Measures and data collection

2.2.1. Quantitative – chart audit and advanced access survey

Primary outcome measures were identified for each area of focus of the LCs (see Table 2). For diabetes care the proportion of documented foot exams was selected as the best process measure as prior research had demonstrated this had the greatest opportunity for improvement, while a reduction in A1c value for patients above target A1c values (A1c ≥ 7.3% at baseline) was selected as a measurable clinical outcome. The A1c study target was defined as 7.3% rather than the Canadian Diabetes Association Clinical Practice Guideline of 7% [25] to identify patients in whom glycemic treatment intensification was more likely. For colorectal cancer screening the proportion of patients who received guideline concordant screening (referral/requisition of FOBT, sigmoidoscopy, or colonoscopy) was the primary outcome. For advanced access, the primary outcome was time (days) to third next available appointment.

Chart audit: Consenting physicians generated a list of patients with T2DM (ICD-9, 250 billing code) and a second list of patients, aged 50–75, for CRC screening based on year of birth and pre-defined evaluation dates. Trained auditors randomly selected patients from each list and screened for eligibility criteria until sample size requirements were met. Patient chart eligibility and timeframe of data collection are described in Table 2. Data collection timeframes were based on dates of participation in QIIP-LC program and, for control physicians, were based on the participation dates of their matched physician participant.

Advanced access survey: The advanced access survey was developed by the external evaluation team based on a review of literature. The survey was administered to those practices participating in the chart audit component of the evaluation to determine the impact of the QIIP-LC program on access to healthcare, and included assessment of the number of days to the third-next available appointment as well as questions on past and current models of access at the practice level (traditional, open access, advanced access). The survey included instructions for measuring the number of days until the third-next-available appointment, and a table to complete with the dates for the first, second, and third-next-available appointment (including date and time of measurement). To reduce the effect of seasonal changes on appointment variability, the surveys were sent once all physicians were recruited for the chart audit.

2.2.2. Qualitative semi-structured interview

To obtain the views of participants, the QIIP implementation team, and QICs, individual telephone interviews (45–90 min) were conducted by a trained facilitator 12 months after the program ended. Semi-structured interview guides were developed in alignment with the QIIP-LC program activities to explore the experiences, perspectives and impact of the QIIP-LC program on the management of

T2DM, CRC screening, and advanced access, as well as the development of team functioning. Interview guides further identified major facilitators and barriers that participants faced, overall perceptions of the QIIP-LC, and recorded participants' levels of satisfaction with the QIIP-LC program. Interviews was audiotaped and transcribed verbatim, with each transcript proof-read by the interviewer to ensure accuracy.

2.3. Sample size

2.3.1. Chart audit and advanced access survey

Sample size calculations were conducted adjusting for clustering and loss to follow-up for the three quantitative primary outcomes (T2DM management [A1c/foot exams], CRC screening and advanced access). The magnitude of change from baseline used in power calculations to demonstrate a clinically significant improvement included: A1c (0.50%); foot exam and CRC screening (20%); and advanced access (four days to third next-available appointment). Taking into account the sample size requirements for each outcome, the final number of physicians required per group was 33.

2.3.2. Qualitative Semi-structured Interview

Saturation of themes was ensured by having 10 PHC teams (each with a minimum of two and a maximum of four team members) that reflected maximum variation by model of care, practice setting, geographic region, and clinical/administrative roles. Additionally, senior program administrators from the QIIP-LC implementation team, and quality improvement coaches (QICs) who had worked with the selected teams during the QIIP-LC were recruited and interviewed.

2.4. Analysis

2.4.1. Quantitative – chart audit and advanced access survey

Chart Audit: Analyses were performed on all outcomes using SAS 9.2 (©SAS Institute Inc.). The generalized linear model (Proc Genmod) was used to compare change in outcome measures from baseline between the QIIP-LC physician (hereafter reported as QIIP group) and control group. Analyses accounted for clustering within the physician's practice and controlled for baseline measures.

Advanced access survey: A Mann–Whitney test was performed to compare the number of days until the third-next available appointment of the QIIP and control practices.

2.4.2. Qualitative semi-structured interview

Each transcript was coded in parallel by two research staff using NVivo9 software. Data analysis was conducted using an iterative and interpretive approach. In the first phase of the analysis each transcript was independently reviewed and coded by the researchers to determine the key concepts emerging from the data. The researchers then met to examine their independent coding, culminating in a consensus that informed the development of the coding template. The second iteration of the analysis involved generation of summaries for each of the main themes with exemplar quotes illustrating the themes. The strategy of immersion and crystallization further assisted in synthesizing the data to provide a comprehensive overview of the key themes [26–28]. Saturation was reached after 31 participant interviews.

3. Results

3.1. Quantitative primary outcome results

Fig. 1 displays the physician recruitment, consent, and the number of patient charts audited. A total of 34 physicians per group consented/completed the chart audit component. Physician and patient demographics were similar (Table 3). For the advanced access survey, 88% of physicians provided outcome data.

Primary outcome result between QIIP and control groups are summarized in Table 4. Participation in the QIIP-LC did not have a significant effect on T2DM management (A1c, $p = 0.10$; foot exams, $p = 0.45$), rate of CRC screening ($p = 0.77$), or advanced access to healthcare ($p = 0.22$) when compared to the control group; however both groups showed a trend towards improvements over time. Mean A1c for patients above study target (A1c $\geq$ 7.3%) was significantly lower in the QIIP group during the program ($p = 0.01$); however these improvements were not sustained 12 months following program completion.

3.2. Qualitative findings

A total of 31 primary healthcare participants, four QIIP senior program administrators, and seven quality improvement coaches consented to participate in the interviews. In this section of the paper, qualitative themes are presented to align with the four goals of the QIIP-LC program: (1) improve T2DM management; (2) increase CRC screening; (3) optimize patient access to primary healthcare ("advanced access"); and (4) improve team functioning.

3.2.1. T2DM management

Overall, QIIP-LC participants perceived that they strengthened their diabetes monitoring and made efforts to improve diabetes process (foot exams), and outcome (A1c) measures to follow clinical practice guidelines more closely.

> I certainly would say that we have seen an improvement in the A1c levels and that's myself learning more about diabetes and diabetes management, being more comfortable with initiating newer medications and insulin. So the A1c levels have improved and I think lipid results have improved as well. (PHC Team)

Teams developed various strategies to systematically follow-up and track patients by developing diabetes registries, flow sheets and reminder systems in EMRs, fostering a sense of improved care by ensuring appropriate and timely follow-up: "*For diabetes, if you didn't come, before no one knew and no one cared. Now if you don't show up, you are invited back". (PHC Team). "[Patient care] certainly has improved by making sure that people are being screened*

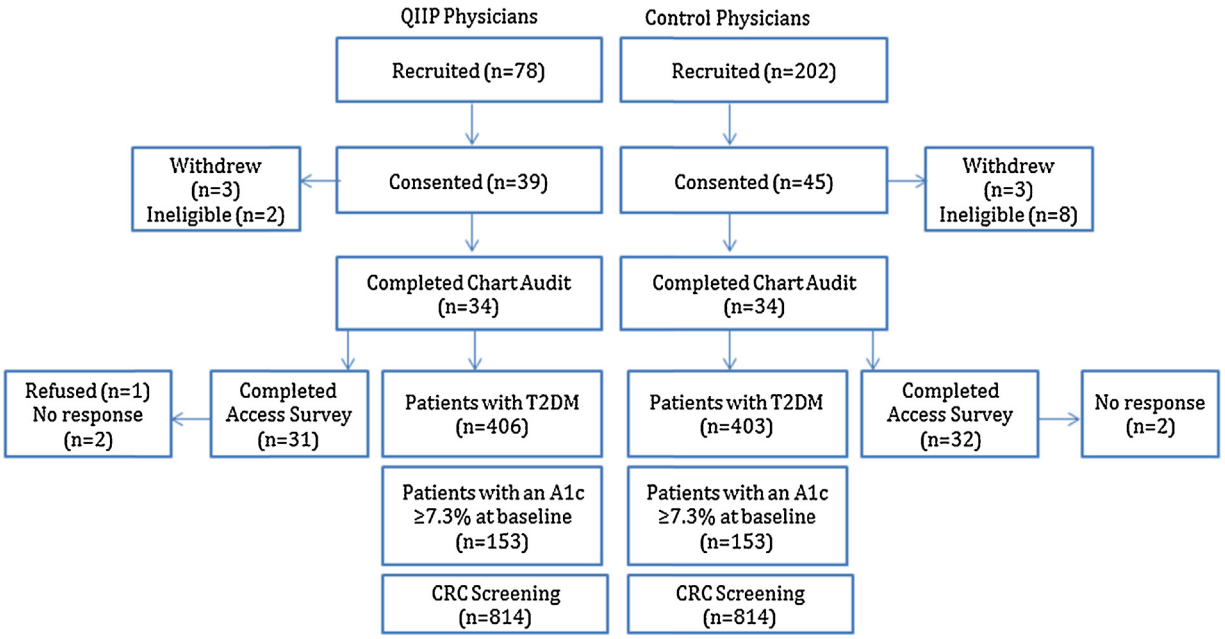

Fig. 1. Physician recruitment, consent, and number of patient charts.

appropriately, having regular A1cs, lipids, foot care, eye exams. I think that's probably the most significant change". (PHC Team)

Similarly, diabetes education was perceived to be enhanced.

> "If you have diabetes, we are checking your A1c, we are referring you to a dietitian. We're running groups and classes. We encourage patients to attend these things. So I think at the end there's much better patient care". (PHC Team)

However, some participants had not observed any change in clinical outcomes for diabetes. *"The clinical outcomes don't really reflect any significant change". (PHC Team)* This was consistent with the QIIP senior program administrators, who observed inconsistent improvement in clinical outcomes across practices that participated in the QIIP-LC. *"The improvements that we saw in reported data were inconsistent across practices. Some made huge gains and they made them quickly, others made smaller gains, and some didn't make any improvements in the measured out-*

Table 3
Baseline demographic characteristics of physicians and patients.

	QIIP	Control
Physician demographics		
Physicians, *N*	34	34
Females, % (*n*)	41.2 (14)	44.1 (15)
Mean years in practice (SD)[a]	23.1 (10.51)	21.2 (9.07)
Rural, % (*n*)	52.9% (18)	52.9% (18)
Patient demographics (foot exam)		
Patient, *N*	406	403
Females, % (*n*)	46.6 (189)	50.9 (205)
Mean age, year (SD)	62.3 (11.43)	62.9 (12.28)
Mean duration of T2DM, year (SD)	6.2 (6.32) *N* = 316	6.0 (5.61) *N* = 324
Patient demographics (A1c[c])		
Patient, *N*	153	157
Females, % (*n*)	45.8 (70)	49.0 (77)
Mean age, year (SD)	54.7 (11.92)	50.4 (12.77)
Mean duration of T2DM, year (SD)[b]	6.9 (5.89) *N* = 119	8.4 (6.82) *N* = 120
Patient demographics (CRC screening)		
Patients, *N* (baseline/post)	814 (407/407)	801 (399/402)
Females, % (*n*)	53.6 (436)[a]	52.7 (422)
Mean age, year (SD)	59.5 (6.64)	59.9 (6.89)

[a] Two patients with missing data.
[b] No significant difference between groups ($p = 0.16$).
[c] Patients above study target A1c ≥ 7.3%.

Table 4
Comparison of quantitative primary outcomes for QIIP and control.

T2DM management		*Baseline*	*During*	***P-value*** *between group (baseline to during[c])*	*Post*	***P-value*** *between group (baseline to post[c])*
Mean A1c % value (SD)[a]	QIIP Control	8.5 (1.25) 8.5 (1.22)	8.1 (1.32) 8.4 (1.51)	**0.01**	8.2 (1.62) 8.4 (1.58)	0.10
Foot exam, % (n)	QIIP Control	28.6 (116) 24.8 (100)	49.3 (200) 35.0 (141)	0.20	48.5 (197) 38.0 (153)	0.15
CRC screening	QIIP		Control			***P-value*** *Between group (baseline to follow-up[c])*
	Baseline	Follow-up	Baseline	Follow-up		
Screened for CRC[b], % (n)	57.7 (235)	66.1 (269)	51.1 (204)	61.7 (248)		0.77
Access	*QIIP*		Control			***P-value*** *between groups*
Mean number of days until third-next available appointment (SD)	5.3 (10.5)		6.6 (8.8)			0.221
Range	0–55		0–41			

[a] Patients above study target (A1c ≥ 7.3%).
[b] FOBT, colonoscopy or sigmoidoscopy.
[c] T2DM management: baseline = 12 months prior to the learning collaborative; post = 12 months post learning collaborative end date; CRC screening: baseline = 24 months prior to the learning collaborative; follow-up = 24 months following the start of the learning collaborative.

comes". (QIIP-LC senior program administrator) One major challenge observed by QIIP-LC senior program administrators was the variability in the EMR systems limiting data extraction.

> The number one barrier from my perspective was the EMR's. . . we lost probably the first three or four months just in the standardization of input data and the challenge of getting data back out of the system. It wasn't such a big issue with access and efficiency because we didn't need the EMR for that, but for diabetes and CRC screening, extracting clinical information was painful. (PHC Team)

3.2.2. CRC screening

Many of the participants from the primary healthcare teams reported that their CRC screening rates improved after their participation in the QIIP-LC due to a redesign of care processes. Teams developed various schemes to identify eligible patients for CRC screening, educated patients about the importance of cancer prevention, and followed up the FOBT kits that were sent out.

> We've gone after patients. Before if you didn't show up, you didn't get offered screening. That was problem number one. Now if people are outside the range that they're supposed to be in, they will get called, inviting them to come in and have a conversation about colorectal screening, which of course creates more patient demand. (PHC Team)

Furthermore, with increased awareness of CRC prevention among the providers and improved tracking systems, they were able to identify at-risk patients based on returning test results and refer patients in a timely fashion for a colonoscopy or to specialists for further treatment. *"We had an increase in FOBT results back, which means that we also had an increase in screening, and we worked on a process for ensuring that the referral was done within a two week period." (PHC Team)*

PHC team participation in the PDSA cycles promoted by the QIIP-LC were credited with some of the improvements experienced by the PHC teams.

> Originally there were the low 50s or high 60s percentages of his [physician lead] patients who needed to be screened, were being screened by the end of the program. It was after doing several PDSAs and so forth [that we got], up into the high 90s. (PHC Team)

Some teams encountered challenges when implementing CRC screening in their practices. One challenge was patient engagement in returning the FOBT kits. *"We put in more protocols that would help remind patients. but you can lead a horse to water, you can't make him drink." (PHC Team)* Another challenge was have a systematic way of documenting in the clinic EMR. *"CRC screening for us was fairly straight forward. It was being well managed, [we] just didn't have a good documentation trail electronically." (PHC Team)*

Some teams found it challenging to focus QI on more than one area with the time constraints of a busy clinic. "To be honest, there wasn't a lot of work done around CRC screening for us. We chose to work mostly with diabetes and access and efficiency." (PHC Team)

3.2.3. Advanced access

The QIIP-LC senior program administrators observed an improvement in access to care for those teams that were successful at implementing the advanced access model.

> For the practices that were successful in implementing advanced access, the benefits to patients have got to be major. I've run into friends and acquaintances whose docs have moved to advanced access and they're just stunned when they phone and they're asked when they would like to come in, as opposed to 'what do you want to come in for?' (QIIP-LC senior program administrator)

However, the PHC team participants reported various levels of improvement in access to care. Some participants

stated that they were able to implement a full advanced access model in their practice.

> Because we are the only family physicians office in the whole town, each of our doctors were at least two to three weeks before their appointment, some of them six to eight weeks before you could get an appointment. Going to advanced access took that literally down to zero. So for our patients it was a radical change. And our patients love it. (PHC Team)

Most PHC team participants perceived that the improvement in access was a result of modifying the advanced access model to meet the needs of their practices. *"It's been a non-stop three years of changing how we schedule clients. Are we as effective as we need to be? I don't think so. I would say we've gone to what's more modified advanced access." (PHC Team)*

Advanced access and staff changes were reported as challenges for rural FHTs who often work part-time across different settings. *"I'm only in the office with this patient population one or two days a week... I felt overwhelmed with same or next day access because I can't do that for my [clinic] patient population with the practice set up this way." (PHC Team)* As well, the teams encountered patients who did not "buy in" to the idea of the advanced access model.

Teams expressed varied opinions on the preferences of patients to changes in advanced access. Some participants perceived advanced access and efficiency as beneficial to patients: *"They get in quicker, they get the answers to their questions."(PHC Team) "Definitely they love the increased access. They love being able to see multiple providers..." (PHC Team).* Alternatively, other participants perceived their patients' preference remaining with their traditional means of receiving care. *"Some patients have been with their doctors for many years and had satisfaction with this kind of continuity of care. They were not interested in a shortened cycle if it meant seeing a resident." (PHC Team)*

3.2.4. Team functioning

A central theme that emerged in the analysis was team readiness for change, a key ingredient to the working as a team and successful participation in the QIIP-LC. 'Readiness' was characterized by: previous experience with QI and data management; adopting a team-approach with attention to team functioning and communication strategies; reflective practice; openness to external advice and support; openness to sharing lessons learned, including both positive and negative data; comfort with trial and error; and having an understanding of the difference between accountability and QI. Successful teams needed to demonstrate a willingness and commitment to the process.

> Teams that had already gotten over the kind of initial organizational hurdles of establishing their team and doing what they had to do to recruit their personnel, and at least had started to work on building a team climate within the organization [had better success with the program]. Others just had so much other work on their plate that it just wasn't feasible... There were still FHTs at the end who were still struggling, just around staff recruitment, team functioning and getting parameters sorted out. (QIIP-LC senior program administrator)

By requiring a composition of interdisciplinary professional roles in each team, the QIIP-LC program provided participants with the opportunity to learn from each other and improve the delivery of primary care in an interdisciplinary team fashion. *"Learning about other people's viewpoints which aren't necessarily your viewpoint was good for colleagues." (PHC Team)* As a consequence, they gained an increased understanding of other's roles and scope of practice. *"It really helped see everybody's role." (PHC Team) "We've learned how to communicate with each other, and generally through process mapping, what other individuals do and what other individuals need to do their job properly." (PHC Team)* Furthermore, there was more perceived trust and respect among team members, and less professional silos. *"Because of the increased collaboration among the different people on the team, it has empowered our front staff and our nursing staff to feel more comfortable coming to us directly with patient concerns." (PHC Team) "We actually developed as a collaborative team, where before we'd been working much more as separated silos, doing our own thing." (PHC Team)* They experienced how a team approach enhanced the delivery of care.

> We developed a team approach to diabetes care ... The goals that the patient sets are stated with the diabetes educator and then the family doctor reinforces what the goals are for the next visits. (PHC Team)

Teams also reported improved team dynamics by sharing a team vision and common goals. Teamwork was recognized as an integral success factor in improving care for patients.

> It was good to be exposed to this kind of bigger picture thinking. It was the networking, the ability to get together with others who are passionate about improving health care and excited to work as a team towards making situations better for our patients. (PHC Team)

Lastly, teams reported that care to patients was improved because of improved team functioning in practice. *"Patients get much better care. They have a team effort looking after them instead of an individual."*

> So ultimately if you have a team that's functioning well, and doing better assessments, you have better patient outcomes. Sometimes that's better patient care, [even if it is not] better patient outcomes, [because] its tough to measure particularly by numerical numbers and specific guidelines. But there is overall improvement in health care based on the improvement of the team. I think the two are absolutely linked. (PHC Team)

4. Discussion

The QIIP-LC program did not demonstrate statistically significant between-group differences in the primary outcome measures (T2DM management: A1c [$p = 0.10$]; foot exams [$p = 0.45$]; rate of CRC screening [$p = 0.77$]; or advanced access to healthcare [$p = 0.22$]). Improvements

over time for physicians in *both* QIIP and control groups likely explains the lack of statistically significant primary outcomes to support the QIIP-LC program; however other characteristics of the program or evaluation design may have contributed to these results and will be described in detail below. These qualitative findings resonate with the quantitative results and reflect triangulation of the multiple datasets in this mixed-method evaluation.

The QIIP-LC program was successful in helping build interdisciplinary team functioning and capacity through improved team interactions and collaborations, an increased understanding of each other's roles, and increased information and resource sharing. Interview findings illuminate the more nuanced and implicit elements of perceived team formation and interaction. Readiness was a key ingredient to successful participation in the QIIP-LC, a consistent theme in the literature vital for the success of a program [29–31]. Understanding each other's role emerged as an important component of team building, [29] and participants described experiencing more trust and respect among team members and fewer professional silos within their teams. Participants also described how a team approach enhanced the delivery of care – they were able to provide better care for their T2DM patients, work together to implement a process where more patients were screened for CRC, and demonstrated more coordinated administrative and clinical staff efforts focused on working together for more timely patient care.

4.1. Explanation of study findings

Although the QIIP-LC chart audit and interview findings demonstrated a trend towards improved delivery of care for patients with diabetes, and efforts to improve T2DM management and CRC screening (proxy for chronic disease management and disease prevention), these improvements did not translate into statistically significant differences between the QIIP and control groups. These results are consistent with previously published literature for T2DM management looking at annual foot exams and mean A1c [32], and rates of CRC screening [33]. Similarly, examination of advanced access scheduling and themes emerging from participant interviews indicated concerted action to improve access to healthcare, with no statistically significant differences in wait times for appointments between groups. Interview findings highlighted many challenges and barriers faced by teams in their attempt to implement an advanced access model, including factors outside of a physician's control (for example, patient's resistance to change), and again, these findings were consistent with the advanced access literature [34].

As noted above, other characteristics of the QIIP-LC program or evaluation may have contributed to the primary outcome results. QIIP-LC participants were encouraged to spread lessons learned to colleagues, which may have led to some degree of contamination and improvements noted in the control group. For example, while both the mean and median number of days to the third-next-available appointment was lower for the QIIP group, the magnitude of the difference was below the level required (three days or more) for the size of this study and not statistically significant. This could be an indication that changes initiated by QIIP-LC participants were integrated into the whole practice organization and thus, control practices within the same FHT may have adopted the new model. Future research could consider interviewing the control group to elucidate the impact of the program and spread of lessons learned between groups.

Qualitative themes highlight some of the underlying challenges physicians and teams faced during the QIIP-LC program that may have impacted the primary outcome results, including limited resources to extract data from electronic medical records to allow teams to measure indicators of quality of care (and thus put the teams 'behind' schedule in the LC), the challenge of focusing on more than one QI area at a time in a busy clinic setting, and factors outside of a physician's control, like patient follow-through and resistance to change. Additionally, the duration of the program and/or evaluation was perhaps insufficient to affect or detect differences in outcomes. The newly formed interdisciplinary teams were only beginning to learn to work as a team [35] and varied in their degree of readiness to change practice. Chin et al. [36] reported that it can take as many as four years after participating in a QI program before A1c values are decreased significantly. Alternatively, the QIIP-LC program may have been strengthened by assisting teams with skills to sustain lessons learned. Statistically significant improvement in foot exams and A1c were noted *during* the program between QIIP and control groups; however, these improvements were not sustained upon program completion.

4.2. Contribution to existing literature

The majority of published QI evaluation studies have relied on self-reported measures and made minimal use of control groups [17–19,24]. Difficulties in evaluating complex interventions in health research have been well documented [37], and this evaluation used an innovative, controlled, retrospective, multi-measure, mixed-method design to cultivate and enhance the field of QI evaluation literature with a robust research design offering a breadth of detail about the impact of a QI collaborative in primary healthcare [18,37]. The purpose of an evaluation is to determine whether results are, in fact, a result of the intervention, and use of this rigorous quantitative methodology with stratified random selection of participants, strengthened by a control group, provides a clearer understanding of the impact of the QIIP-LC on program participants. Use of a control group in the QIIP-LC evaluation demonstrates the rigour that should be expected in the future when evaluating QI initiatives. The QIIP-LC program evaluation was further strengthened by a mixed-method research design, allowing triangulation of the qualitative and quantitative findings, and offered insight into some of the underlying factors that may explain the results presented here-in. The retrospective nature of the evaluation offered protection against detection bias, with the primary outcome measures unknown to the participants during the QIIP-LC program. The qualitative interviews were representative of the participating teams,

with maximum variation in clinical and administrative roles within the team, illuminating the more nuanced and implicit elements of the QIIP-LC program.

Second, organizations involved in the design and implementation of QI programs must take other local, regional or provincial primary healthcare programs or initiatives into consideration to optimize the impact of the QI program. While the QIIP-LC program was underway, the MOHLTC ran parallel programming and incentives to family physicians across Ontario for diabetes management, CRC screening, and advanced access to comply with best practices. These programs may have contributed to the improvements seen in both QIIP and control groups, and may explain the lack of statistically significant primary outcomes to support the QIIP-LC program [38–42]. Furthermore, many FHTs and CHCs were in the process of implementing a mandated EMR which may have contributed to improvements seen in both groups [43–45]. QI programs must be judiciously designed to improve care above and beyond related initiatives in the environment to ensure added value, particularly given the financial and resource intensive nature of QI LCs. As is evident in this research and existing literature, QI LCs have the potential to improve primary healthcare and team-based care, and this research highlights the importance of prioritizing evaluation of these initiatives to inform future program planning, evaluation and health policy.

Third, to be able to evaluate the success of these programs, the implementation team must consider evaluation prior to program implementation. Program evaluation should become a central tenet of QI initiatives, with small scale pilot studies evaluated prior to wide-spread programmatic roll-out [2,3,13]. This will ensure resources are tailored to ensure maximum impact. The QIIP-LC program may have been limited in its effectiveness by targeting too many areas for improvement, thus overwhelming participants and reducing the effect of the intervention, or the program content may not have sufficiently addressed barriers to QI and with sufficient intensity to overcome clinical inertia [46]. These kinds of issues regarding implementation strategies of programs need to be effectively addressed by management teams at the beginning of any initiative if the programs are to yield detectable differences in evaluation outcomes. Long-term research on the sustainability of QI LCs and additional research on a program's effectiveness are needed to inform QI planning, implementation, and evaluation.

4.3. Evaluation limitations

The QIIP-LC program evaluation was conducted in a real-world setting, and therefore had a number of limitations with participation bias on multiple levels. Clinical teams who volunteered to participate in the program may have been more agreeable to changing their practice, and this bias may have been further heightened by the need to have informed consent to participate in the evaluation. Similarly, control physicians may have had a particular interest in the evaluation outcomes, suggesting that these physicians may have had a vested interest in improving their practice. The design of the evaluation may have also presented a number of limitations. The retrospective nature of the evaluation limited the design to matched controls and a one time cross-sectional mean for advanced access. A change in advanced access over time would have been a better measure, and future research should consider using a prospective, pre-post approach. Furthermore, the decision to recruit control physicians from the same FHT as QIIP-LC physicians to ensure matching by model of care and resources may have contributed to a degree of contamination. Lastly, physicians or team members in the control group were not interviewed to explore their level of exposure to the QIIP-LC or determine if they were participating in other interventions. Determining an appropriate control group is often difficult in an environment where other factors or changes may be taking place [47,48]; however future research could look at expanding the qualitative component to the control group to offer insight into potential contamination and seek to mitigate these concerns.

4.4. Recommendations for future QI programs and evaluation in primary healthcare

To be able to effectively evaluate the success of QI programs, comprehensive program evaluation should be conducted concurrently with program implementation, with spread to other practices limited until after the evaluation is complete, or controlled for in the evaluation design (for example, qualitative interviews of both intervention and control groups) to elucidate the impact of the program. This will ensure a program or strategy is evaluated and thus evidence-based and positioned to inform policy makers and practitioners. Furthermore, a cost-effectiveness analysis should be included in all future evaluations to support the significant financial investment of QI programs like QIIP, and to guide health policy and planning. Lastly, education programs where primary healthcare clinicians and administrators learn together, and work together, should be supported, with a particular emphasis on pre-participation work to ensure team members have an adequate understanding of workload and programmatic requirements prior to program involvement. By participating together, team functioning is enhanced and as is evident through this evaluation, a key success of QI initiatives like QIIP. Recent literature supports the potential of interprofessional, team-based care, and it would be prudent for health policy and funding to continue to endorse QI programs in PHC designed to enhance collaborative and interprofessional team-based care for patients with chronic conditions [49–52].

5. Conclusion

Improvements over time for physicians in *both* QIIP and control groups likely explains the lack of statistically significant primary outcomes to support the QIIP-LC program. Other characteristics of the QIIP-LC program or evaluation design may have contributed to these results, including the intensity of the program, selection of controls, contamination between QIIP and control groups, or other concomitant reasons. The qualitative findings resonate with the improvements noted in the QIIP group's quantitative results and reflect triangulation of the multiple datasets in

this mixed-method evaluation. The QIIP-LC program was successful in helping build interdisciplinary team functioning and capacity through improved team interactions and collaborations, an increased understanding of each other's roles, and increased information and resource sharing.

QI-LCs like QIIP are designed to target the challenges of developing a chronic disease management strategy by providing participants the opportunity to learn to work together as a team and optimize allied healthcare provider skills to improve care and adherence to guidelines for patients. Improved prevention, management of chronic diseases, access to healthcare and efficient office practice design may significantly reduce the strain on Ontario's healthcare system, and continued emphasis must be placed on the evaluation of these initiatives in primary healthcare to inform decision makers with evidence-based information to guide healthcare policy, planning, and funding.

Conflict of interest

The authors report no conflicts of interest. The findings and conclusions reported in this evaluation are those of the author's and not necessarily those of affiliated organizations or institutions.

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